

APPENDIX C

RELATIVE RISK ASSESSMENT

U.S. Department
of Transportation

United States
Coast Guard



Commander
Fifth Coast Guard District

431 Crawford Street
Portsmouth, VA 23704-5004
Staff Symbol: (oan)
Phone: (804)398-6285

16500
14 May 1996

Department of the Army
Baltimore District
U.S. Army Corps of Engineers
Attn: Jeff McKee
P.O. Box 1715
Baltimore, MD 21203-1715

Gentlemen:

The relative risk assessments of the Brewerton Channel Eastern Extension and the Tolchester S-Turn have been completed for the scenarios as you requested and are attached. In addition, we have included scenarios for 1-way traffic in the existing and proposed Tolchester Channels.

It should be noted that these relative risk factor assessments were performed using new ARRF software which has existed since late 1992. Results from the new software cannot be accurately compared to results from the older software, however due to the more sophisticated computations, yield a much better result. If you have further questions regarding this issue, please contact LT Mike Shomin of my staff at the above number.

Sincerely,

A handwritten signature in dark ink, appearing to read "J. R. Walters", written over the typed name.

J. R. WALTERS
Chief, Waterways Management Section
U. S. Coast Guard
By direction of the Commander,
Fifth Coast Guard District

SECTION ONE
TABLE OF CONTENTS

| | <u>Page</u> |
|--|-------------|
| 1.0 INTRODUCTION..... | 1-2 |
| 1.1 PURPOSE..... | 1-2 |
| 1.2 BACKGROUND AND INTERPRETATION..... | 1-3 |
| 1.2.1 Simulator Experiments..... | 1-3 |
| 1.2.2 Performance Measures..... | 1-5 |
| 1.2.3 Application and Interpretation of the Risk Relative Factor (RRF)..... | 1-7 |
| 1.3 OVERVIEW OF THIS MANUAL AND THE EVALUATION PROCESS..... | 1-8 |

1.0 INTRODUCTION

1.1 PURPOSE

The Waterway Design Manual supplements the short range aid (SRA) system design guidelines presented in Chapter 4 of the Aid to Navigation Manual - Administration (United States Coast Guard, COMDTINST M16500.7) and provides an additional tool for the Waterway Analysis and Management System (WAMS). This Waterway Design Manual differs from other tools in that it focuses on the provision of SRA systems to the relatively high risk and high cost operations of deep draft vessels transiting narrow channels. For this type of operation, it provides a quantitative measure of quality, or risk, for candidate systems. The Design Manual is accompanied by the Automated Relative Risk Factor (ARRF) Computation Program, Version 2. 1B, custom software for the United States Coast Guard (USCG) Standard Work Station. The user's manual for the Program is embedded in this Design Manual. Together, the Manual and the Program provide a "job aid" for the design and evaluation process. (Note that they replace an earlier Manual (Smith et al., 1985) and earlier software, Version 1.1. The earlier Manual and software produced relatively conservative risk estimates. The new versions are based on new, highly-refined performance data and produce lower, more realistic, risk estimates. For this reason, results with the two sets of materials are not compatible and should not be mixed or compared.)

The Design Manual guides the user through the evaluation process for the subject waterway. The general approach is, first, to select a "design vessel" to represent the traffic in a waterway and to divide the waterway into "regions" that will enclose the distance needed by this vessel to perform each of the maneuvers that comprise a transit. Conditions of the transit are then specified as inputs to the Program. They include characteristics of the design vessel, width and turn configurations of the waterway, environmental conditions, and SRA configurations (existing or considered). Based on this input, the Program provides a "relative risk factor" (RRF) for each region of the waterway. RRF values can be used to compare the risk in regions along a waterway, or to compare risk under alternative SRA systems or alternative conditions.

The design and evaluation process is a tool for the assessment of risk; the user's objective is the management of risk. Management techniques, that are appropriate for the use of the relative risk factor, are suggested and discussed. Briefly, the techniques and examples of their use are as follows:

1. Designing for comparable risk at least cost. The user selects an existing set of conditions with a known record of acceptance and safety and uses it as a baseline to which to compare

alternative SRA systems or operational practices. The assumption is that an alternative that achieves the same level of RRFs as the existing system has the same expectations for safety. This approach is recommended as the primary one because of its potential for the control of costs. Examples of management objectives that can be served by this technique include the following:

- ♦ to seek uniform risk along a waterway
- ♦ to prioritize work along a waterway
- ♦ to justify reductions in service along a waterway
- ♦ to evaluate design proposals or requests
- ♦ to respond to changing needs

2. Designing for minimal risk. The user evaluates alternative SRA systems and operation practices for a waterway to identify the lowest RRFs possible in that waterway. The assumption is that the alternative that achieves the lowest values provides the maximum safety. This alternative will probably prove the most costly and should be implemented only when circumstances justify additional cost. Examples of applications of this technique include:

- ♦ to support critical military use
- ♦ to ensure safety for sensitive cargoes
- ♦ to establish the lower limit of risk for the waterway

The Design Manual provides a structured and systematic process for the design and evaluation of SRA systems and an objective assessment of risk, but the user's judgment is required at every step. To inform this judgment, a discussion of the background of the process and the nature of the RRF measure follows.

1.2 BACKGROUND AND INTERPRETATION

1.2.1 Simulator Experiments

Real-time man-in-the-loop simulation was used to provide controlled and replicated performance data not obtainable at sea. Performance data are "generic," that is, not specific to any waterway but applicable to a wide variety of related waterways and conditions. The subject of the experiments was the "system" formed by the waterway, the ship, the shiphandler, the environment, and the SRA configuration. Each component could be varied and investigated in turn. Repeated runs under standardized conditions were made for each variation. As an example, repeated runs with a high density of SRAs were made under the same conditions as those made with a low density of SRAs. Performance in each case provided a measure of the relative performance, or risk, to be expected with such an SRA configuration. Each component included in the experiments is described briefly below.

1. The waterway. The majority of runs were made with channels 500 feet wide. Variations in width were allowed for very large ships and to establish a general effect of channel width. Because the intention was to evaluate the information provided by the SRA system, there were no bank or sidewall effects that might provide additional information about the ship's position. Turns were 15 or 35 degrees and cutoff or not cutoff at the "corner." (Relevant waterway conditions are described where needed in Sections 4.2, 4.3 and 4.4.)

2. The ship. Sophisticated hydrodynamic models were used to represent large, commercial ships. Only the most difficult to handle types, tankers and bulk carriers, were included and these were modeled fully loaded. Ships ranged in size from 30,000 deadweight tons to 250,000 deadweight tons. (Ship characteristics are described where needed in Section 4.1.)

3. The shiphandler. The shiphandlers were commercial pilots with active state and federal licenses and recent experience with the ship and waterway dimensions they tested. Because they did not have "local knowledge" of the generic waterways, their performance was strongly dependent on the information provided by the SRA system and provides a strict measure of its quality. Other shiphandlers might not necessarily achieve the same performance for these demanding conditions. For less expert shiphandlers the calculated results may under-estimate risk.

4. The environment. Conditions incorporated in the process here include day and night and variations in wind and current. For the sake of experimental control, the greater pool of performance data were collected under simplified conditions of one-way traffic and adequate visibility. It was assumed that the best SRA systems for these conditions would also be the best for two-way traffic and reduced visibility (with radar). This assumption was tested and supported. A brief overview of the findings on reduced visibility and traffic appears in Section 5.2.4.

5. The SRA configurations. It was assumed that visual piloting is the basic technique for piloting in restricted waterways and that the primary purpose of the design process was to evaluate the service provided for this basic technique. To this end, the majority of the simulation was designed to provide performance data on day and nighttime SRAs, positioned at their charted position at the channel edge, and for visual ranges. Visibility was adequate for the aids being evaluated. In order to ensure that performance data were a measure of the effectiveness of the SRAs of interest, no land or other objects were available to provide additional positioning information. Radar was not available unless it was the subject of the investigation. Additional findings on floating SRAs, landmass, and radar and electronic navigational displays are discussed briefly in Section

5.2.4. (SRA configurations are described in Section 4.3, 4.4, and 4.5 where needed.)

1.2.2 Performance Measures

During the experiments the primary measure was of the cross-channel position of ship tracks as pilots made repeated runs under the same set of conditions. The assumption was that good performance, or low risk, would be achieved when the pilots were certain of their position and had good control of the ship. This low risk would be characterized by a precision of tracks: that is, the mean of the distribution would be close to the centerline, the standard deviation would be small, and there would be a good distance to the channel edge from both sides of the distribution. Poorer performance, as when the pilots had less certainty of their position or more difficulty controlling the ship, would be characterized by a greater mean distance from the centerline or a larger standard deviation of the distribution. Either way in which poorer performance was expressed, less distance from the channel edge would be available to one or the other side. This smaller distance would mean greater "risk" of grounding.

These measurement assumptions are the basis of an index called the Relative Risk Factor (RRF). The general concept of the RRF is illustrated in Figure 1.2.2. For a specified set of conditions and for a specified waterway region, the mean crosstrack position of the ship's center of gravity during multiple transits by multiple pilots is selected to represent the characteristic maneuver for that region. This mean crosstrack position is adjusted, for the ship's beam and the heading relative to the channel course, to represent the distributions of the two extreme points of the ship's contour most exposed to the channel edge. A Gaussian distribution, with the observed standard deviation, is assumed around each of the extreme means. The probabilities of grounding to port (P_p) and to starboard (P_s) are calculated. The total probability of grounding on either channel edge is the RRF for that region of the channel. The derivation of this measure is discussed in earlier reports (Smith et al, 1985 and Bertsche, Smith, Marino, and Cooper, 1982).

The values of the RRF will vary with a number of parameters:

- ♦ the experimentally derived cross-channel distribution of tracks for conditions. This parameter is selected by the Program based on conditions specified by the user. Specification of conditions is described in Section 4.
- ♦ the length and beam of the design vessel. These parameters must be input by the user. Design Vessel parameters are discussed in Section 4.1.
- ♦ the design vessel's heading relative to the channel direction

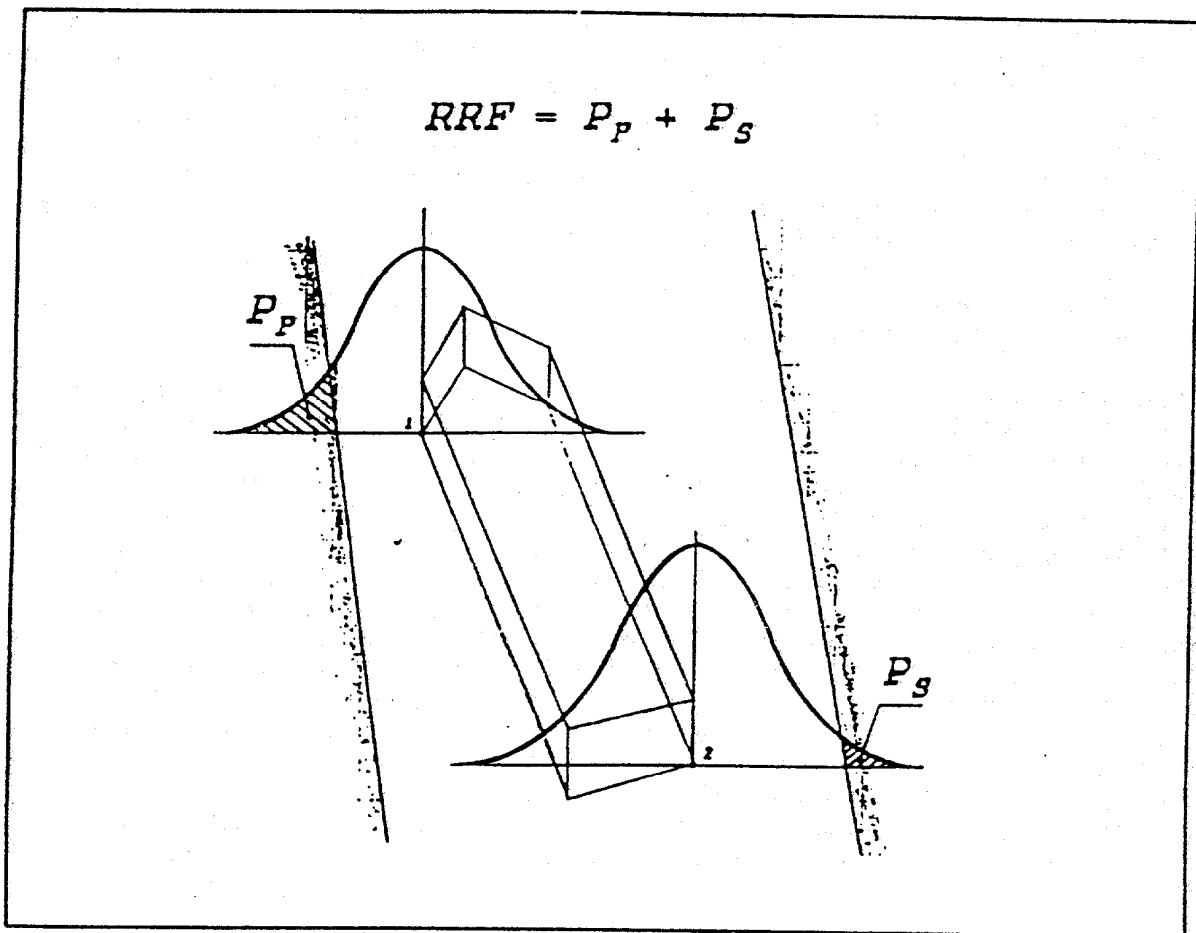


FIGURE 1.2.2. THE GENERAL CONCEPT OF THE RELATIVE RISK FACTOR

as required by maneuver: turn, recovery, or trackkeeping. The maneuver is specified by the user as directed in Sections 4.2, 4.3, and 4.4. The Program will select the appropriate heading during calculations.

- ♦ the design vessel's heading relative to the channel direction as required by the wind and current conditions. The user will specify the wind and current effect as directed in Sections 4.2, 4.3, and 4.4. The resulting heading will be calculated by the Program from user input.

1.2.3 Application and Interpretation of the Relative Risk Factor (RRF)

The methodology described above suggests a number of implications for the application and interpretation of RRF values:

- ♦ Only conditions that were evaluated during the experiments, or in subsequent data analyses, can be appropriately evaluated. For example, the performance of highly-maneuverable vessels in very narrow channels cannot be addressed.
- ♦ The RRF is a relative measure, assumed to be proportional to an actual or realistic probability of grounding for a set of conditions, rather than being itself an absolute probability of grounding. As such, it is most appropriate for comparisons among conditions evaluated by the same process, comparisons that will be suggested in the following sections. It should not be used for management techniques that require an absolute measure of performance.
- ♦ The RRF is a "conservative" measure and will yield higher estimates of the risks of grounding in a waterway region than can be defended as realistic. As an example, an RRF value of 0.3 is not uncommon, but cannot be interpreted as a realistic expectation that 3 out of 10 transits will ground in the region. Instead, conservatism provides a margin for conditions not included in the consideration or not foreseen. Section 4 contains suggestions for the manipulation of the degree of conservatism by the user.
- ♦ While the risk of "grounding" is emphasized here, it is assumed that this risk is related to those of collisions and rammings. Conditions that allow the pilot to make accurate and timely estimates of his ship's position, velocity, and acceleration should contribute generally to the safety of a waterway transit.

1.3 OVERVIEW OF THIS MANUAL AND THE EVALUATION PROCESS

An annotated table of contents for rest of report is presented below.

2.0 INFORMATION COLLECTION AND PREPARATION contains a brief overview of a recommended information collection. Generally, this is the similar to that suggested in the Aids to Navigation Manual - Administration as a part of the WAMS process. Familiarity with the contents of this Design Manual early in the WAMS process will ensure that all needed information is available. This section also contains expanded directions for dividing the chart of the waterway into "regions."

3.0 USER'S MANUAL FOR THE AUTOMATED RELATIVE RISK FACTOR (ARRF) COMPUTATION PROGRAM is the only user's manual for the program. It assumes the user is familiar with the USCG Standard Work Station.

4.0 "JOB AID" FOR ENTERING DATA provides guidance for the specification of the conditions of interest: design vessel characteristics, channel width and turn configurations, existing and potential SRA arrangements, environment, etc. A major feature of the program is a series of data input screens, requesting this information. The Program itself repeats critical portions of this guidance in the form of help screens. The accuracy and applicability of the output is dependent on the accuracy of the input.

5.0 INTERPRETATION AND APPLICATION OF THE RESULTS contains, first, a discussion of the report printed by the program. More importantly, it contains a discussion of risk management procedures appropriately supported by the program.

SECTION FIVE

TABLE OF CONTENTS

| | <u>Page</u> |
|---------|--|
| 5.0 | INTERPRETATION AND APPLICATION OF THE RESULTS.... 5-2 |
| 5.1 | WATERWAY ANALYSIS REPORT..... 5-2 |
| 5.2 | RISK MANAGEMENT..... 5-3 |
| 5.2.1 | Introduction..... 5-3 |
| 5.2.2 | Designing for Comparable Risk at Least Cost..... 5-3 |
| 5.2.2.1 | To Seek Uniform Risk Within a Waterway..... 5-3 |
| 5.2.2.2 | To Prioritize Work Within a Waterway..... 5-4 |
| 5.2.2.3 | To Justify Reduction in Service Within a Waterway..... 5-4 |
| 5.2.2.4 | To Evaluate Requests for Change..... 5-4 |
| 5.2.2.5 | To Respond to Changes in Operations..... 5-6 |
| 5.2.2.6 | To Justify Reductions in Response to Decreased Needs..... 5-6 |
| 5.2.2.7 | To Use a Second Waterway as Baseline..... 5-6 |
| 5.2.3 | Designing for Minimum Risk..... 5-7 |
| 5.2.3.1 | To Ensure Safety for Sensitive Cargoes or Environments..... 5-7 |
| 5.2.3.2 | To Establish the Lower Limit of Risk for the Waterway..... 5-8 |
| 5.2.4 | Transient Conditions and Waterway Risk..... 5-8 |
| 5.2.4.1 | Targets of Opportunity or Landmass..... 5-8 |
| 5.2.4.2 | Floating SRAs..... 5-9 |
| 5.2.4.3 | Meeting Traffic..... 5-9 |
| 5.2.4.4 | Radar or Electronic Navigation Displays, in Reduced or Full Visibility..... 5-10 |
| 5.2.5 | The Last Word on Risk Management..... 5-11 |

5.0 INTERPRETATION AND APPLICATION OF THE RESULTS

5.1 WATERWAY ANALYSIS REPORT

The Waterway Analysis Report is printed by instructions appearing in Section 3.2.2.3. A sample report appears as Appendix B.

The first block on the report repeats the inputs for Waterway, File Name, and Comments from the Create/ Select a Waterway File form described in Section 3.3.2.

The second block repeats the inputs for the Design Vessel Parameters Form described in Sections 3.3.3 and 4.1.

The third block is the "totem pole," drawn within the capabilities of the alphanumeric terminal of the USCG Standard Work Station. The totem pole is a vertical axis representing a range of RRF values, here from less than or equal to .000 to equal to or greater than .900. Three such poles are presented here, labeled "Day," "Night," and "Range." On each pole are plotted the RRF values for each region taken from the Region Data Forms described in Sections 3.3.3, 3.3.5, 3.3.6 and 4.2, 4.3, and 4.4. Each region is represented by the Region Code given it on the Form. Approximately six region codes can appear on the same line of the plot. If there are additional regions at a single RRF value, they will not appear on the plot, but they will be included in the rest of the report. The purpose of the plot is to sort the regions by RRF values and isolate those regions with conspicuously high risk for special consideration. The application of this plot is discussed further in Section 5.2 that follows.

The following blocks on the report are reproductions of each Region Data Form with all its inputs and the calculated RRFs as they were presented on the screen. These forms are described in Sections 3.3.3, 3.3.5, 3.3.6 and 4.3, 4.4, and 4.5. They are printed in the order in which they were saved. The reproduction of these forms serves as a record of what was input and of what the RRFs are for the input conditions, presumably the actual conditions.

The final blocks repeat the sequence of regions with Region Configuration Options. For each region, the block reproduces the Region Code, Region Description, Region Width, Cross Current, and, for turn regions, the Turn Angle and Turn Type. These reproduced inputs are followed by calculated RRF values for these conditions and all the alternative SRA systems that the Program considers: short and long gated, short and long staggered, one sided, all these for day and night, and high and low sensitivity ranges. The purpose of this presentation is to allow the easy examination of all the "configuration options" for the conditions in the region. The application of these options is discussed in Section 5.2, which follows.

5.2 RISK MANAGEMENT

5.2.1 Introduction

The design process as directed by the Manual to this point has been involved with risk assessment, the measurement of the risk of specified conditions and the provision of a quantitative measure of this risk, the RRF. The remainder of this section involves risk management, the application of the results to the broader objectives of the system designer. While the RRF is a valuable measure, its relative nature limits its use in management to the comparison of alternative arrangements or conditions. The nature of the RRF measure was discussed here in Section 1.1. The following discussion describes two basic techniques that proceed by comparison, and discusses the support of management objectives by these techniques.

Some of the objectives discussed here are relevant to the direction provided in Aids to Navigation Manual - Administration, Chapter 3 Establishment, Review, and Modification of Coast Guard Aids to Navigation Systems.

5.2.2 Designing for Comparable Risk at Least Cost

"Designing for comparable risk at least cost" is recommended as the primary technique because it includes the possibility of controlling costs. It is applied below to a variety of management objectives. They are arranged by the degree of complexity required in selecting an appropriate comparison or baseline standard of risk. For the first three, all comparisons are made within one waterway and all calculations needed are already available in the Waterway report described in Section 5.1. The next three require copying the Waterway file and changing some of the conditions. The last one is the most complex in that it requires the use of another waterway for comparison.

5.2.2.1 To Seek Uniform Risk Within a Waterway

The establishment of uniform risk throughout a waterway is recommended as a first, basic objective of management within a waterway. The totem pole readily serves this objective. One version is included in the Waterway report described in Section 5.1 and presented as Appendix A. First, examine the plot for conspicuously high risk regions. Note that the highest risk regions will usually be turn regions. The differences in severity of the maneuvers will limit just how uniform risk can be. Look also for conspicuous difference among the subsystems of day, night, and range. If there is a dependence on unlighted SRAs, there may be a difference between day and night, especially in difficult turns. If so, the nighttime subsystem should be carefully re-considered for its adequacy in providing the needed service.

If there are ranges present, there may be considerable difference between visibilities that allow their use and those that do not. Does the distribution of expected visibilities justify dependence on ranges? Is there a need to improve the system of sidemarks for lower visibilities?

The original version of the Totem pole appears as Figure 5.2. In the figure the axis is a multi-cycle logarithmic scale. Note that it preserves the order of the RRF values but not the intervals between them. The resolution is high for the lower RRF values but decreases for the higher values. The values from 0.1 to 1 are compressed into the top quarter of the scale. The figure can be copied and regions of special interest plotted to support management decisions.

5.2.2.2 Prioritize Work Within a Waterway

A companion objective to the establishment of uniform risk is the assignment of priorities for work within a waterway. Regions and subsystems identified as having conspicuously high risk within the waterway should be given the highest priority for work.

5.2.2.3 To Justify Reduction in Service Within a Waterway

Some regions may have conspicuously low risk, suggesting them as candidates for low priority and even for a reduction in service. However tempting a reduction in service may be, caution is necessary. Re-examine the region for the presence of risk factors such as those listed in Section 2.4, factors such as shoals, currents, close turns, etc. Consider such transient increases in risk as meeting traffic or reduced visibility, discussed further in Section 5.2.4 below. Include appropriate user groups early in the process to receive their input and increase their final acceptance. Look into historical reasons for the original markings. If the reduction in service follows from a policy of seeking uniform risk, an SRA may be shifted from a region of low risk to a region of high risk and the change presented as an increase in overall service in the waterway.

5.2.2.4 To Evaluate Requests for Change

Consideration of changes to existing conditions is somewhat more complex in that the needed calculations are not readily available from a single Waterway report. New calculations for the new conditions are needed. Care should be taken that the only differences between the original, baseline conditions and the new conditions are those of interest and that there are no unwanted differences to bias results. Comparisons may be relatively simple and certain if historical conditions provide an appropriate baseline or standard against which to examine the new conditions. As an example, if there is a request for an improvement in the

WATERWAY NAME AND LOCATION: _____
 DESIGN/EVALUATION OBJECTIVE: _____

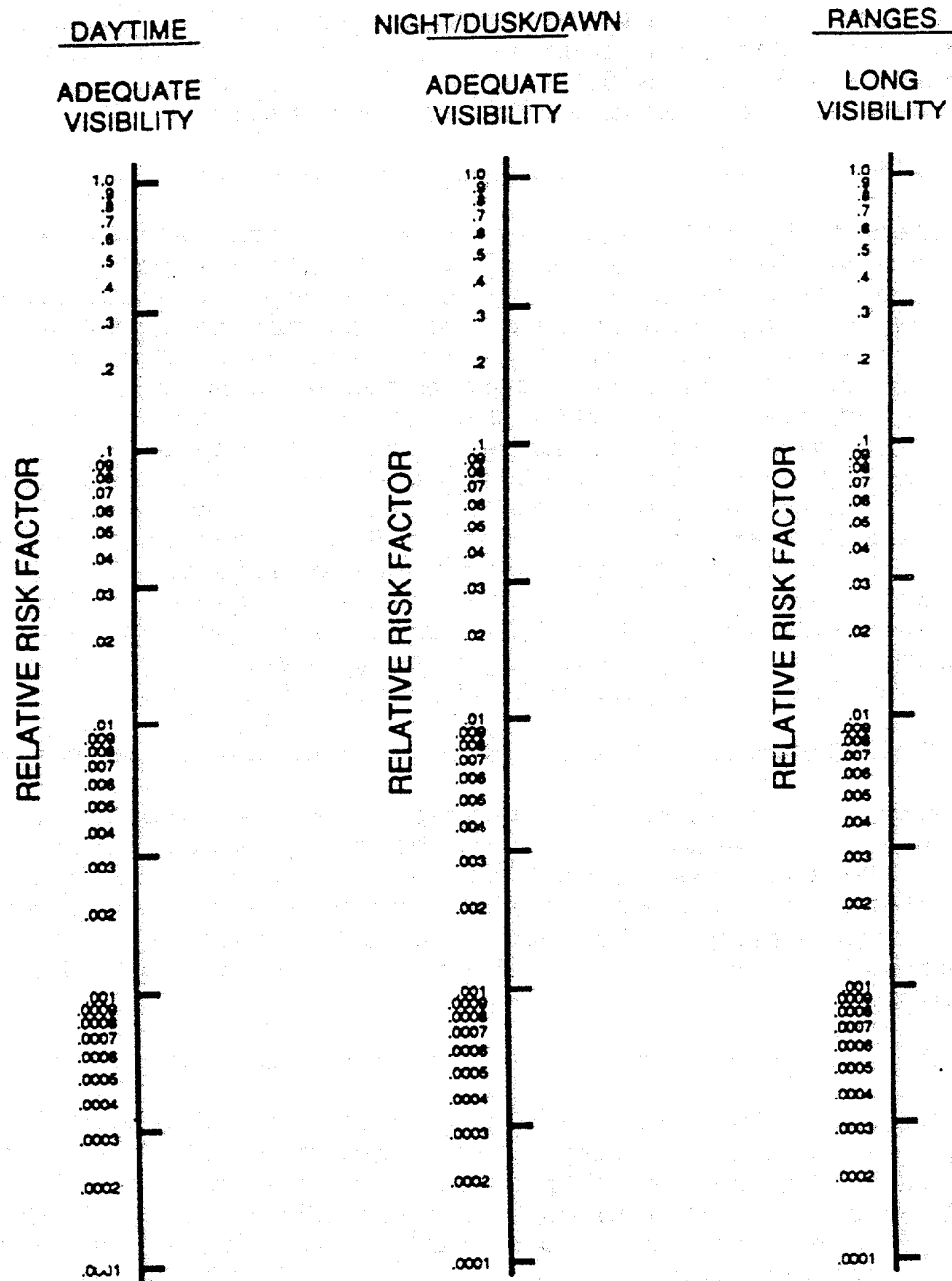


Figure 5.2 "Totem Pole" for Graphic Summary of Relative Risk Factor (RRF) Values for Single Waterway

nighttime subsystem, the present nighttime subsystem will set an upper level for risk and the daytime subsystem will set a lower limit for what can be expected. Copy the original Waterway file according to the instructions in Section 3.3.2.3 and change the nighttime SRAs as requested. Instructions for input are in Sections 3.3.4, 3.3.5, 3.3.6, 4.3, 4.4, and 4.5. The requested changes can be evaluated in such a context.

5.2.2.5 To Respond to Changes in Operations

A related objective is a response to changes in operations. An example would be a request for entry to the port for a larger ship than has been customary in the waterway. Historical experience with a smaller ship presents an appropriate baseline. Copy the smaller ship's Waterway file as directed in Section 3.3.2.3 and change the design vessel parameters as instructed in Sections 3.3.3 and 4.2. Risk with the larger ship can be compared to risk with the smaller or baseline ship. If they are conspicuously different, an effort should be made to lower risk with the larger ship to that obtained with the smaller. The *Configuration Options* in the Waterway report may offer SRA system changes that lower the risk. Note that the comparison being made in this second step is the small ship with SRA Arrangement A versus the large ship with SRA Arrangement B. As an alternative to SRA system changes, operational restrictions might be placed on the larger ship. Such restrictions are discussed in Section 5.2.3 below.

5.2.2.6 To Justify Reductions in Response to Decreased Needs

Changes in operations may suggest the possibility of decreasing service. For example, larger ships may discontinue visits to a port. In this case, the larger ship may offer a baseline and the same level of risk may be achieved by a smaller ship with fewer SRAs. The designer is cautioned to consider all factors which may contribute to risk, or to the perception of risk, before such a reduction.

5.2.2.7 To Use a Second Waterway As Baseline

A single waterway will not always provide the needed standard for comparison. As an example, consider the larger ship in Section 5.2.2.5. It may not be possible to lower its risk to that of the smaller ship. One can consider the possibility that the level of risk for the smaller ship is lower than is really needed. For this consideration, compare the risk of the larger ship in the subject waterway to the risk of that ship in another waterway where it does have a history of safe passage. For another example, the risk in a waterway when its range is obscured might be compared to that in a waterway with similar conditions that never had a range.

Using a second waterway to establish a standard is less simple in that it involves additional work in the selection and analysis of the other waterway. It is also less certain in that the potential for bias in the comparison is much increased. The most certain comparison is one between conditions that differ on only one factor (for example, ship size or day/night). When a second waterway is used, many factors may differ. Sections 2 and 4 here provide a substantial list of the factors that can affect performance or a measured RRF and must be considered in establishing an appropriate comparison.

5.2.3 Designing for Minimum Risk

5.2.3.1 To Ensure Safety for Sensitive Cargoes or Environments

There may be times when the appropriate objective is to design a waterway for the "minimum risk" possible in the waterway. Obvious examples are the transit of hazardous cargoes through fragile ecosystems or through areas of high population density. Such a system will not be the lowest cost and the need for safety should justify added cost. See the Aids to Navigation Manual - Administration Chapter 3 for guidance on justifying cost.

There are a number of approaches to designing for minimum risk. One is to examine the *Configuration Options* in the Waterway report for the SRA arrangement that results in the lowest risk. Consider ranges if they are not already present, if the problems are not in the turns, and if the local visibilities justify their use. Reject any arrangement that requires a greater number of SRAs to achieve the same or nearly the same risk as the existing system.

If a satisfactory "minimum" risk cannot be achieved in all regions by the use of SRAs consider the following low risk conditions:

- ♦ daylight, with or without the addition of extra unlighted aids
- ♦ long visibilities, with added ranges
- ♦ slack current and minimum wind
- ♦ one way operations.

If one of these restrictions will bring the risk sufficiently low, consider recommending to the Captain of the Port that operations be restricted to the safest conditions.

If such restriction will not bring risk low enough, consider:

- ♦ a wider channel
- ♦ cutoff turns

If these changes do bring risk down, consider recommending this dredging to the U.S. Army Corps of Engineers. (Performance data

for cutoff and noncutoff turns may not be appropriately comparable.)

Additional possibilities are discussed in Section 5.2.4.

5.2.3.2 To Establish the Lower Limit of Risk for the Waterway

The system designer might want to design for minimum risk, as in Section 5.2.3.1, to establish the lower limit of risk for the waterway. The intention might not be to implement the resulting design, but to compare what-is to what-might-be. The comparison might support the argument--addressed to the mariner--that the existing system is at or near the minimum risk. Or it might support the argument--addressed to Headquarters--that it is far from the minimum and needs additional resources for improvement.

5.2.4 Transient Conditions and Waterway Risk

The primary objective of the design process presented here, and of the simulator experiments that provided the needed performance data, was to evaluate the contribution of SRA systems to the total risk in a waterway. In serving this objective, simplifying assumptions were made and some complicating, transient factors were omitted. To evaluate the service provided by the SRAs, competing sources of information which the pilots might use instead of or in addition to these aids were omitted. These included land masses and targets of opportunity, bank or sidewall effects, radar, and electronic navigation systems. For the sake of simplicity in analysis, other elements omitted included floating SRAs and on-coming traffic. Although not included in the design process here, the effects of these factors were evaluated by simulator experimentation. A brief overview of the principal findings of these additional findings is included here to assist in the final understanding and management of risk in a waterway.

5.2.4.1 Targets of Opportunity or Landmass

The Aids to Navigation Manual - Administration Chapter 4 states that "aids only supplement natural and manmade landmarks...existing geographic composition must be considered throughout the design process." In response to this statement of priority, the findings of one experiment deliberately manipulated the trade-off between SRA system and the features of a nearby landmass (Brown, Smith, and Forstmeier, 1988). The principal conditions evaluated and conclusions drawn included the following:

- ♦ A baseline channel marked with three aids in the turn, long-spaced gates in the straightaways, and no land in sight showed the best performance. No combination of lower density of aids and landmass was as good. When performance is critical, SRAs must support it.

Land within 2.5 nautical miles (nm) of the channel did improve performance with a lower density of aids. Performance varied with density of land-based objects and the distance to land. Benefits were greatest in the turn region, less in the recovery, and least in the trackkeeping. The findings are consistent with the principle that the complexity of the visual environment contributes to the pilot's ability to judge relative motion during maneuvers. Fixed lights close to the turn region make a particularly valuable contribution at night.

Under limited conditions, conspicuous objects provide special benefits. A target of opportunity is an effective addition when the pilots report (and agree) that they consistently make use of it and it is within 0.5 nm of the channel edge at the region for which it is being considered. For this single region, assume that the risk is equal to the best value in the *Configuration Options Report*.

5.2.4.2 Floating SRAs

The Aids to Navigation Manual - Positioning describes floating aids according to their Accuracy Classifications, the distance from the charted position within which a floating aid can be expected to lie. The principal results of an experiment (Brown, Smith, and Conway, 1989) designed to evaluate the effects of difference in accuracy of position are as follows.

Performance deteriorates, or risk increases, with the distance of aid displacement because pilots compensate for some but not all of it. When the displacement is caused by current, the crab angle required of the ship increases the effective beam and increases risk further.

Performance is affected in complex ways by the direction of the current and the resulting displacement. Effects can be favorable or harmful for a particular maneuver.

5.2.4.3 Meeting Traffic

The meeting of two large, commercial ships in a narrow channel may be the greatest risk in a transit and its lack of inclusion in an analysis may affect the credibility of the results. A dedicated experiment was run to determine whether the design guidelines derived from the pool of data on one-way transits was equally valid for two-way transits (Moynihan and Smith, 1985; Smith, Marino, and Multer, 1985). Results were not quantitatively comparable because risk in this single experiment was expressed as the combined risk of grounding and collision. The general conclusion was that the best arrangements for one-way traffic were the best arrangements for two-way traffic. A brief review of the findings follow:

- ♦ The beneficial effects of Type 3 rather than Type 2 marking continued far down the next leg. After a good turn, short-spaced gates were only slightly better than long-spaced gates.

- ♦ Bank effects tended to keep the ships away from the channel edge, verifying the conservatism of data collected without such effects.

- ♦ The risk is much greater if ships must meet before recovery is complete.

- ♦ The effects of ship size go beyond the obvious fact that a larger ship takes up more crosstrack space in the channel. A larger and less maneuverable ship tends to hold its track in the channel, putting greater burden on the on-coming ship to maneuver.

5.2.4.4 Radar or Electronic Navigation Displays, in Reduced or Full Visibility

While it is U.S. Coast Guard policy to provide SRA system for visual piloting, commercial ships and highly trained pilots do make substantial use of radar. To investigate the relation between visual piloting and the use of radar, a dedicated experiment was run, adding to the simulation a simple, generic plan position indicator (PPI) display and passive reflectors on the SRAs (Smith, Marino, and Multer, 1985; Multer and Smith, 1983). The general conclusion was that the best arrangement of SRAs for visual piloting is also the best for radar piloting. Principal findings included the following:

- ♦ Pilots reported that they prefer visual piloting and resist getting underway without adequate visibility. When forced to get under way under marginal conditions, they usually do not combine methods but give dominance to whichever is expected to be most useful for most of the transit. The other method becomes secondary.

- ♦ In the turn region, radar and visual piloting do enhance each other. Pilots used radar range to the turn apex to start the turn, starting earlier than they did with visual alone, an action that contributes to a superior turn. After the start of the turn, they switched their attention to the visual SRAs to judge the angular motion of the ship around the apex.

- ♦ In the recovery and trackkeeping regions, radar and visual piloting did not combine as well. Performance with radar and gated SRAs was poorer in reduced visibility than it was in zero visibility. Apparently, switching between radar and SRAs for crosstrack position was a distraction.

♦ The best radar performance was seen with the gated SRA arrangement. Staggered arrangements resulted in poorer performance even with the additional contributions of radar. There was no support for the expectation that low densities of SRAs are made sufficient by radar.

A number of experiments have been done investigating the use of electronic navigation systems in restricted waterways (Smith, 1992; Smith and Mandler, 1992; Gynther and Smith, 1989; Smith, Marino, and Multer, 1985; Cooper, Marino, and Bertsche, 1981a, Cooper, Marino, and Bertsche, 1981b). A summary of all of these is beyond the scope of the present Manual, but some overall conclusions are relevant here.

♦ A variety of positioning accuracies and display types showed adequate or even superior performance in the recovery and trackkeeping regions under a variety of visibilities. The observed performance is very similar to that observed with visual ranges, offering support for the use of such technologies when ranges are desirable but not practical.

♦ The turn maneuver sets the limit for the use of any particular electronic system. Good performance through severe turns requires good positioning accuracies, sophisticated displays, some visibility, and/or practiced pilots.

5.2.5 The Last Word on Risk Management

William D. Ruckelshaus, former Administrator of the U.S. Environmental Protection Agency, has the last word on risk management: "Although there is an objective way to manage it, nor can we ignore the subjective perception of risk in the ultimate management of a particular [risk]. To do so would be to place too much credence in our objective data and ignore the possibility that occasionally one's intuition is right. No amount of data is a substitute for judgment."

(THIS PAGE INTENTIONALLY LEFT BLANK)

Waterway : TOLCHESTER
 File Name: TOLCHESTN2.WWF
 Comments : Proposed 600' wide for 2-way traffic

Design Vessel Displ. (tons): 58988.40
 Size (dwt): 55000.00
 Length (ft): 965.00
 Beam (ft): 106.00
 Draft (ft): 33.00
 Ht of Eye(ft): 90.00
 Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.52
 Nomoto Par. K* (-): 1.34
 Nomoto Par. T* (-): 2.60

Totem Pole:

| Day RRF | Night RRF | Range RRF |
|------------------|-----------|-----------|
| > 0.900 T2 | T2 | |
| 0.800 | T1 | |
| 0.700 T1 | | |
| 0.600 | | |
| 0.500 | | |
| 0.400 | | |
| 0.300 | | |
| 0.200 | R1 R2 | |
| 0.100 K1 K2 K3 | K1 K2 K3 | |
| 0.090 R1 R2 | | |
| 0.080 | | |
| 0.070 | | |
| 0.060 | | |
| 0.050 | | |
| 0.040 | | |
| 0.030 | | |
| 0.020 | | |
| 0.010 | | |
| 0.009 | | |
| 0.008 | | |
| 0.007 | | |
| 0.006 | | |
| 0.005 | | |
| 0.004 | | |
| 0.003 | | |
| 0.002 | | |
| 0.001 | | |
| 0.000 | | |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 104

Region Code : T1 Description : UP CHES LB 29-30

Turn configuration (check one)

NonCutoff: X Cutoff: Bend:

```

Turn angle (deg) : 13.00      Day: Type (1 - 3) : 2      Conforming? : Y
                             Night: Type (1 - 3) : 2      Conforming? : Y

```

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

```

Range Data                                     Sensitivity :
Separation (yds) :                             Distance (yds):
Front height (ft) :                           Rear height (ft) :

```

RRF Day: 0.7102 Night: 0.8486 Range: Not Ready

[illegible]

Region Code : T2A Description : UP CHES LB 27 & 28

Turn configuration (check one)

NonCutoff: X Cutoff: Bend:

```

Turn angle (deg) : 26.00      Day: Type (1 - 3) : 2      Confirming? : Y
                             Night: Type (1 - 3) : 2      Confirming? : Y

```

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

```

Range Data                                     Sensitivity :
Separation (yds) :                             Distance (yds):
Front height (ft) :                           Rear height (ft) :

```

RRF Day: 1.0000 Night: 1.0000 Range: Not Ready

=====

Recovery Region Data

Region Code : R1A Description : Upp Ches CH LB's 24 & 25

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
 Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

| | | |
|---------------------|--|--------------------|
| Range Data | | Sensitivity : |
| Separation (yds) : | | Distance (yds): |
| Front height (ft) : | | Rear height (ft) : |

RRF Day: 0.0953 Night: 0.2363 Range: Not Ready

=====

Recovery Region Data

Region Code : R2A Description : Up Ches CH LB's 13 & 14

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
 Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

| | | |
|---------------------|--|--------------------|
| Range Data | | Sensitivity : |
| Separation (yds) : | | Distance (yds): |
| Front height (ft) : | | Rear height (ft) : |

RRF Day: 0.0953 Night: 0.2363 Range: Not Ready

=====

Trackkeeping Region Data

Region Code : K1A Description : Up Ches CH LB's 21 & 22

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|--------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side |

Day: Conforming? : Y Night: Conforming? : Y

| | |
|---------------------|--------------------|
| Range Data | Sensitivity : |
| Separation (yds) : | Distance (yds): |
| Front height (ft) : | Rear height (ft) : |

RRF Day: 0.1575 Night: 0.1575 Range: Not Ready

=====

Trackkeeping Region Data

Region Code : K2A Description : Up Ches CH LB's 18 & 19

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|--------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side |

Day: Conforming? : Y Night: Conforming? : Y

| | |
|---------------------|--------------------|
| Range Data | Sensitivity : |
| Separation (yds) : | Distance (yds): |
| Front height (ft) : | Rear height (ft) : |

RRF Day: 0.1575 Night: 0.1575 Range: Not Ready

=====

Trackkeeping Region Data

Region Code : K3A Description : Up Ches CH LB's 15 & 16

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data Sensitivity :

 Separation (yds) : Distance (yds):

 Front height (ft) : Rear height (ft) :

RRF Day: 0.1575 Night: 0.1575 Range: Not Ready

=====

Turn Region Configuration Options

Region Code : T1 Region Description : UP CHES LB 29-30

Region Width : 300.00 Cross Current : 0.50 Turn Angle : 13.00

Turn Type : NonCutoff

| | Daytime RRF Values | Nighttime RRF Values |
|------------|--------------------|----------------------|
| Type One | : 0.7102 | 0.8486 |
| Type Two | : 0.7102 | 0.8486 |
| Type Three | : 0.7102 | 0.7749 |

High Sensitivity Range : 0.8437

Low Sensitivity Range : 0.8943

=====

Turn Region Configuration Options

Region Code : T2 Region Description : UP CHES LB 27 & 28
 Region Width : 300.00 Cross Current : 0.50 Turn Angle : 26.00
 Turn Type : NonCutoff

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 1.0000 | 1.0000 |
| Type Two | : 1.0000 | 1.0000 |
| Type Three | : 1.0000 | 0.9246 |

High Sensitivity Range : 1.0000
 Low Sensitivity Range : 1.0000

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : Upp Ches CH LB's 24 & 25
 Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0953 | 0.2363 |
| Long Gated | : 0.0953 | 0.2363 |
| Short Staggered | : 0.2630 | 0.2630 |
| Long Staggered | : 0.4181 | 0.4181 |
| One Sided | : 0.5029 | 0.5029 |

High Sensitivity Range : 0.1923
 Low Sensitivity Range : 0.6420

=====

Recovery Region Configuration Options

Region Code : R2 Region Description : Up Ches CH LB's 13 & 14
 Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0953 | 0.2363 |
| Long Gated | : 0.0953 | 0.2363 |
| Short Staggered | : 0.2630 | 0.2630 |
| Long Staggered | : 0.4181 | 0.4181 |
| One Sided | : 0.5029 | 0.5029 |

High Sensitivity Range : 0.1923
 Low Sensitivity Range : 0.6420

=====

Trackkeeping Region Configuration Options

Region Code : K1 Region Description : Up Ches CH LB's 21 & 22
 Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0360 | 0.0360 |
| Long Gated | : 0.1575 | 0.1575 |
| Short Staggered | : 0.1651 | 0.1651 |
| Long Staggered | : 0.2529 | 0.2529 |
| One Sided | : 0.3267 | 0.3267 |

High Sensitivity Range : 0.0001
 Low Sensitivity Range : 0.5865

=====

Trackkeeping Region Configuration Options

Region Code : K2 Region Description : Up Ches CH LB's 18 & 19
Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

Short Gated : 0.0360

0.0360

Long Gated : 0.1575

0.1575

Short Staggered : 0.1651

0.1651

Long Staggered : 0.2529

0.2529

One Sided : 0.3267

0.3267

High Sensitivity Range : 0.0001

Low Sensitivity Range : 0.5865

=====

Trackkeeping Region Configuration Options

Region Code : K3 Region Description : Up Ches CH LB's 15 & 16
Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

Short Gated : 0.0360

0.0360

Long Gated : 0.1575

0.1575

Short Staggered : 0.1651

0.1651

Long Staggered : 0.2529

0.2529

One Sided : 0.3267

0.3267

High Sensitivity Range : 0.0001

Low Sensitivity Range : 0.5865

Waterway : TOLCHESTER

File Name: TOLCHESTN1.WWF

Comments : Proposed 600' wide for 1-way traffic

Design Vessel Displ. (tons): 58988.40
Size (dwt): 55000.00
Length (ft): 965.00
Beam (ft): 106.00
Draft (ft): 33.00
Ht of Eye(ft): 90.00
Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.52
Nomoto Par. K* (-): 1.34
Nomoto Par. T* (-): 2.60

Totem Pole:

| Day RRF | Night RRF | Range RRF |
|---------|----------------|----------------|
| > 0.900 | | |
| 0.800 | | |
| 0.700 | | |
| 0.600 | | |
| 0.500 | | |
| 0.400 | T1 T2 | |
| 0.300 | | |
| 0.200 | | |
| 0.100 | | |
| 0.090 | | |
| 0.080 | | |
| 0.070 | | |
| 0.060 | | |
| 0.050 | | |
| 0.040 | | |
| 0.030 | | |
| 0.020 | | |
| 0.010 | | |
| 0.009 | | |
| 0.008 | | |
| 0.007 | | |
| 0.006 | | |
| 0.005 | | |
| 0.004 | | |
| 0.003 | | |
| 0.002 | | |
| 0.001 | | |
| 0.000 | R1 R2 K1 K2 K3 | R1 R2 K1 K2 K3 |

[illegible]

Turn configuration (check one)

```
Turn angle (deg) :   13.00      Day: Type (1 - 3) : 2       Confirming? : Y  
                      Night: Type (1 - 3) : 2        Confirming? : Y
```

```

Range Data                                     Sensitivity :
Separation (yds) :                             Distance (yds):
Front height (ft) :                          Rear height (ft) :

```

RRF Day: 0.1192 Night: 0.4325 Range: Not Ready

|||||

Turn configuration (check one)

```

Turn angle (deg) : 26.00      Day: Type (1 - 3) : 2      Conforming? : Y
                             Night: Type (1 - 3) : 2      Conforming? : Y

```

```

Range Data                                     Sensitivity :
Separation (yds) :                             Distance (yds):
Front height (ft) :                          Rear height (ft) :

```

RRF Day: 0.2384 Night: 0.4905 Range: Not Ready

=====

Recovery Region Data

Region Code : R1A Description : Upp Ches CH LB's 24 & 25

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |

Day: Conforming? : Y Night: Conforming? : Y

| | |
|---------------------|--------------------|
| Range Data | Sensitivity : |
| Separation (yds) : | Distance (yds): |
| Front height (ft) : | Rear height (ft) : |

RRF Day: 0.0000 Night: 0.0005 Range: Not Ready

=====

Recovery Region Data

Region Code : R2A Description : Up Ches CH LB's 13 & 14

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |

Day: Conforming? : Y Night: Conforming? : Y

| | |
|---------------------|--------------------|
| Range Data | Sensitivity : |
| Separation (yds) : | Distance (yds): |
| Front height (ft) : | Rear height (ft) : |

RRF Day: 0.0000 Night: 0.0005 Range: Not Ready

=====

Trackkeeping Region Data

Region Code : K1A Description : Up Ches CH LB's 21 & 22

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Day: Conforming? : Y Night: Conforming? : Y

Range Data Sensitivity :
 Separation (yds) : Distance (yds):
 Front height (ft) : Rear height (ft) :

RRF Day: 0.0000 Night: 0.0000 Range: Not Ready

=====

Trackkeeping Region Data

Region Code : K2A Description : Up Ches CH LB's 18 & 19

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Day: Conforming? : Y Night: Conforming? : Y

Range Data Sensitivity :
 Separation (yds) : Distance (yds):
 Front height (ft) : Rear height (ft) :

RRF Day: 0.0000 Night: 0.0000 Range: Not Ready

=====

Trackkeeping Region Data

Region Code : K3A Description : Up Ches CH LB's 15 & 16

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data Sensitivity :

 Separation (yds) : Distance (yds):

 Front height (ft) : Rear height (ft) :

RRF Day: 0.0000 Night: 0.0000 Range: Not Ready

=====

Turn Region Configuration Options

Region Code : T1 Region Description : UP CHES LB 29-30

Region Width : 600.00 Cross Current : 0.50 Turn Angle : 13.00

Turn Type : NonCutoff

| | Daytime RRF Values | Nighttime RRF Values |
|------------|--------------------|----------------------|
| Type One | : 0.1192 | 0.4325 |
| Type Two | : 0.1192 | 0.4325 |
| Type Three | : 0.1192 | 0.2325 |

High Sensitivity Range : 0.4070

Low Sensitivity Range : 0.5719

=====

Turn Region Configuration Options

Region Code : T2 Region Description : UP CHES LB 27 & 28
 Region Width : 600.00 Cross Current : 0.50 Turn Angle : 26.00
 Turn Type : NonCutoff

Daytime RRF Values

Nighttime RRF Values

Type One : 0.2973

0.5185

Type Two : 0.2384

0.4905

Type Three : 0.1791

0.2942

High Sensitivity Range : 0.8682

Low Sensitivity Range : 1.0000

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : Upp Ches CH LB's 24 & 25
 Region Width : 600.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

Short Gated : 0.0000

0.0005

Long Gated : 0.0000

0.0005

Short Staggered : 0.0012

0.0012

Long Staggered : 0.0172

0.0172

One Sided : 0.0563

0.0563

High Sensitivity Range : 0.0000

Low Sensitivity Range : 0.1403

=====

Recovery Region Configuration Options

Region Code : R2 Region Description : Up Ches CH LB's 13 & 14
Region Width : 600.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0005 |
| Long Gated | : 0.0000 | 0.0005 |
| Short Staggered | : 0.0012 | 0.0012 |
| Long Staggered | : 0.0172 | 0.0172 |
| One Sided | : 0.0563 | 0.0563 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.1403

=====

Trackkeeping Region Configuration Options

Region Code : K1 Region Description : Up Ches CH LB's 21 & 22
Region Width : 600.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0000 |
| Long Gated | : 0.0000 | 0.0000 |
| Short Staggered | : 0.0000 | 0.0000 |
| Long Staggered | : 0.0008 | 0.0008 |
| One Sided | : 0.0018 | 0.0018 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.0490

=====

Trackkeeping Region Configuration Options

Region Code : K2 Region Description : Up Ches CH LB's 18 & 19
 Region Width : 600.00 Cross Current : 0.50

| Daytime RRF Values | | Nighttime RRF Values |
|---------------------------------|----------|----------------------|
| Short Gated | : 0.0000 | 0.0000 |
| Long Gated | : 0.0000 | 0.0000 |
| Short Staggered | : 0.0000 | 0.0000 |
| Long Staggered | : 0.0008 | 0.0008 |
| One Sided | : 0.0018 | 0.0018 |
| High Sensitivity Range : 0.0000 | | |
| Low Sensitivity Range : 0.0490 | | |

=====

Trackkeeping Region Configuration Options

Region Code : K3 Region Description : Up Ches CH LB's 15 & 16
 Region Width : 600.00 Cross Current : 0.50

| Daytime RRF Values | | Nighttime RRF Values |
|---------------------------------|----------|----------------------|
| Short Gated | : 0.0000 | 0.0000 |
| Long Gated | : 0.0000 | 0.0000 |
| Short Staggered | : 0.0000 | 0.0000 |
| Long Staggered | : 0.0008 | 0.0008 |
| One Sided | : 0.0018 | 0.0018 |
| High Sensitivity Range : 0.0000 | | |
| Low Sensitivity Range : 0.0490 | | |

Waterway : TOLCHESTER

File Name: TOLCHESTER2.WWF

Comments : Existing 600-foot wide for 2-way traffic

Design Vessel Displ. (tons): 58988.40

Size (dwt): 55000.00

Length (ft): 965.00

Beam (ft): 106.00

Draft (ft): 33.00

Ht of Eye(ft): 90.00

Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.52

Nomoto Par. K* (-): 1.34

Nomoto Par. T* (-): 2.60

Totem Pole:

| Day RRF | Night RRF | Range RRF |
|---------|-------------|-----------|
| > 0.900 | | |
| 0.800 | T1 T2 T3 T4 | |
| 0.700 | | |
| 0.600 | | |
| 0.500 | | |
| 0.400 | | |
| 0.300 | | |
| 0.200 | R1 R2 | |
| 0.100 | | |
| 0.090 | | |
| 0.080 | | |
| 0.070 | | |
| 0.060 | | |
| 0.050 | | |
| 0.040 | | |
| 0.030 | | |
| 0.020 | | |
| 0.010 | | |
| 0.009 | | |
| 0.008 | | |
| 0.007 | | |
| 0.006 | | |
| 0.005 | | |
| 0.004 | | |
| 0.003 | | |
| 0.002 | | |
| 0.001 | | |
| 0.000 | | |

=====

Turn Region Data

Region Code : T1 Description : UP CHES LB 29-30

Turn configuration (check one)

NonCutoff: X Cutoff: Bend:

Turn angle (deg) : 13.00 Day: Type (1 - 3) : 2 Conforming? : Y
Night: Type (1 - 3) : 2 Conforming? : Y

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

Range Data Sensitivity :
Separation (yds) : Distance (yds):
Front height (ft) : Rear height (ft) :

RRF Day: 0.7102 Night: 0.8486 Range: Not Ready

=====

Turn Region Data

Region Code : T2A Description : UP CHES LB 27 & 28

Turn configuration (check one)

NonCutoff: X Cutoff: Bend:

Turn angle (deg) : 6.00 Day: Type (1 - 3) : 2 Conforming? : Y
Night: Type (1 - 3) : 2 Conforming? : Y

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

Range Data Sensitivity :
Separation (yds) : Distance (yds):
Front height (ft) : Rear height (ft) :

RRF Day: 0.7102 Night: 0.8486 Range: Not Ready

=====

Turn Region Data

Region Code : T3A Description : UP CHES LB 21, 24 & 25

Turn configuration (check one)

NonCutoff: Cutoff: X Bend: Extra width (ft) : 0.00

Turn angle (deg) : 12.00 Day: Type (1 - 3) : 3 Conforming? : N
Night: Type (1 - 3) : 3 Conforming? : N

Straight segment width : 300.00 Max crosstrack current (kts) : 0.50

Range Data Sensitivity :
Separation (yds) : Distance (yds):
Front height (ft) : Rear height (ft) :

RRF Day: 0.7494 Night: 0.8769 Range: Not Ready

=====

Turn Region Data

Region Code : T4A Description : UP CHES LB 18-19-22

Turn configuration (check one)

NonCutoff: Cutoff: X Bend: Extra width (ft) : 0.00

Turn angle (deg) : 9.00 Day: Type (1 - 3) : 3 Conforming? : Y
Night: Type (1 - 3) : 3 Conforming? : Y

Straight segment width : 300.00 Max crosstrack current (kts) : 0.50

Range Data Sensitivity :
Separation (yds) : Distance (yds):
Front height (ft) : Rear height (ft) :

RRF Day: 0.6105 Night: 0.8065 Range: Not Ready

=====

Recovery Region Data

Region Code : R1A Description : Upp Ches CH LB's 15 & 16

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : Sensitivity :
Front height (ft) : Distance (yds):
Rear height (ft) :

RRF Day: 0.0953 Night: 0.2363 Range: Not Ready

=====

Recovery Region Data

Region Code : R2A Description : Upp Ches CH LB's 13 & 14

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.50

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : Sensitivity :
Front height (ft) : Distance (yds):
Rear height (ft) :

RRF Day: 0.0953 Night: 0.2363 Range: Not Ready

=====

Turn Region Configuration Options

Region Code : T1 Region Description : UP CHES LB 29-30
Region Width : 300.00 Cross Current : 0.50 Turn Angle : 13.00
Turn Type : NonCutoff

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 0.7102 | 0.8486 |
| Type Two | : 0.7102 | 0.8486 |
| Type Three | : 0.7102 | 0.7749 |

High Sensitivity Range : 0.8437
Low Sensitivity Range : 0.8943

=====

Turn Region Configuration Options

Region Code : T2 Region Description : UP CHES LB 27 & 28
Region Width : 300.00 Cross Current : 0.50 Turn Angle : 6.00
Turn Type : NonCutoff

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 0.7102 | 0.8486 |
| Type Two | : 0.7102 | 0.8486 |
| Type Three | : 0.7102 | 0.7749 |

High Sensitivity Range : 0.8437
Low Sensitivity Range : 0.8943

=====

Turn Region Configuration Options

Region Code : T3 Region Description : UP CHES LB 21, 24 & 25
Region Width : 300.00 Cross Current : 0.50 Turn Angle : 12.00
Turn Type : Cutoff Extra Width : 0.00
Nonconforming (Configuration or Environment)

| | Daytime RRF Values | Nighttime RRF Values |
|------------|--------------------|----------------------|
| Type One | : 0.9963 | 1.0000 |
| Type Two | : 0.7494 | 0.8769 |
| Type Three | : 0.7494 | 0.8769 |

High Sensitivity Range : 0.8437
Low Sensitivity Range : 0.8943

=====

Turn Region Configuration Options

Region Code : T4 Region Description : UP CHES LB 18-19-22
Region Width : 300.00 Cross Current : 0.50 Turn Angle : 9.00
Turn Type : Cutoff Extra Width : 0.00

| | Daytime RRF Values | Nighttime RRF Values |
|------------|--------------------|----------------------|
| Type One | : 0.9140 | 1.0000 |
| Type Two | : 0.6105 | 0.8065 |
| Type Three | : 0.6105 | 0.8065 |

High Sensitivity Range : 0.8437
Low Sensitivity Range : 0.8943

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : Upp Ches CH LB's 15 & 16
Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0953 | 0.2363 |
| Long Gated | : 0.0953 | 0.2363 |
| Short Staggered | : 0.2630 | 0.2630 |
| Long Staggered | : 0.4181 | 0.4181 |
| One Sided | : 0.5029 | 0.5029 |

High Sensitivity Range : 0.1923
Low Sensitivity Range : 0.6420

=====

Recovery Region Configuration Options

Region Code : R2 Region Description : Upp Ches CH LB's 13 & 14
Region Width : 300.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0953 | 0.2363 |
| Long Gated | : 0.0953 | 0.2363 |
| Short Staggered | : 0.2630 | 0.2630 |
| Long Staggered | : 0.4181 | 0.4181 |
| One Sided | : 0.5029 | 0.5029 |

High Sensitivity Range : 0.1923
Low Sensitivity Range : 0.6420

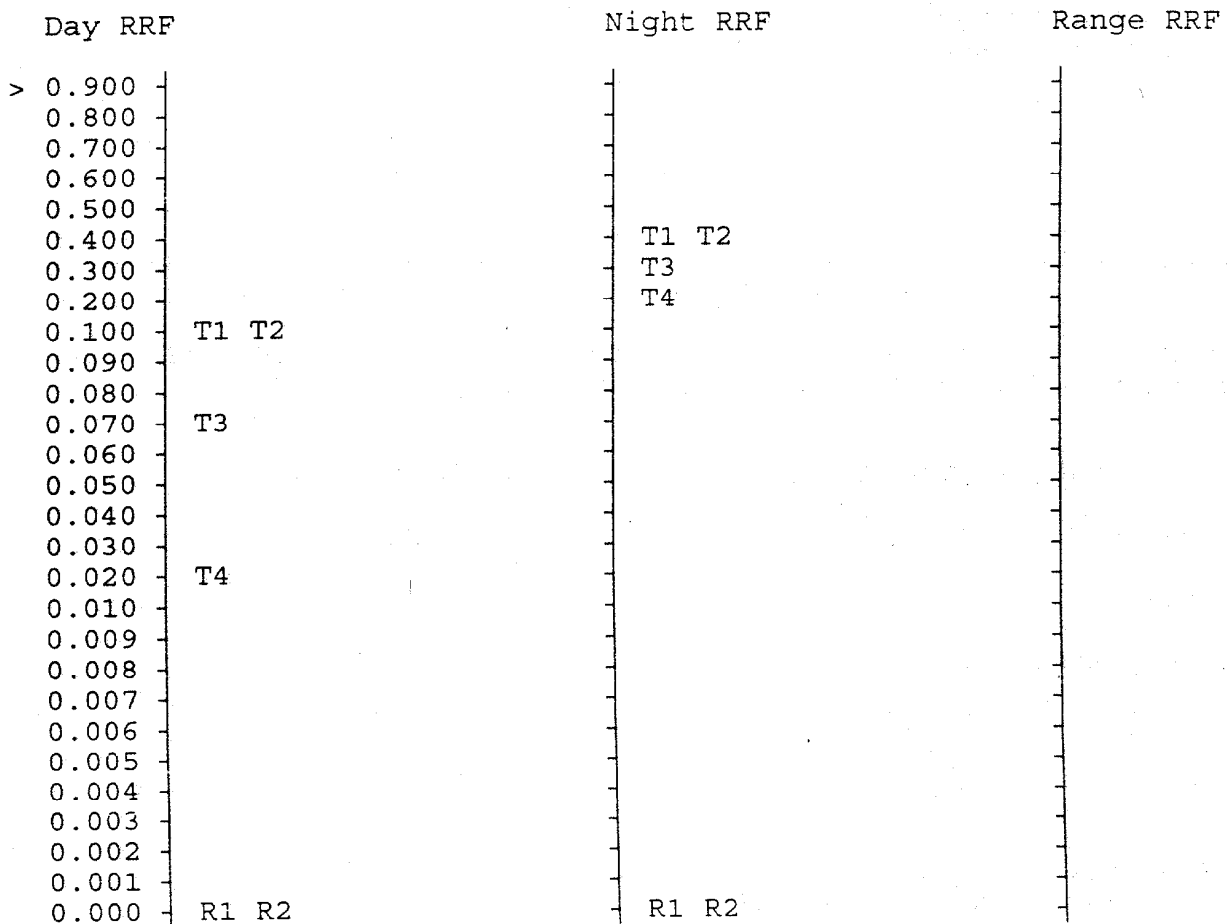
Waterway : TOLCHESTER
 File Name: TOLCHESTER.WWF
 Comments : Existing 600-foot wide for 1-way traffic

Design Vessel Displ. (tons): 58988.40
 Size (dwt): 55000.00
 Length (ft): 965.00
 Beam (ft): 106.00
 Draft (ft): 33.00
 Ht of Eye(ft): 90.00
 Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.52
 Nomoto Par. K* (-): 1.34
 Nomoto Par. T* (-): 2.60

Totem Pole:



=====

Turn Region Data

Region Code : T1 Description : UP CHES LB 29-30

Turn configuration (check one)

NonCutoff: X Cutoff: Bend:

Turn angle (deg) : 13.00 Day: Type (1 - 3) : 2 Conforming? : Y
 Night: Type (1 - 3) : 2 Conforming? : Y

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

Range Data Sensitivity :
 Separation (yds) : Distance (yds):
 Front height (ft) : Rear height (ft) :

RRF Day: 0.1192 Night: 0.4325 Range: Not Ready

=====

Turn Region Data

Region Code : T2A Description : UP CHES LB 27 & 28

Turn configuration (check one)

NonCutoff: X Cutoff: Bend:

Turn angle (deg) : 6.00 Day: Type (1 - 3) : 2 Conforming? : Y
 Night: Type (1 - 3) : 2 Conforming? : Y

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

Range Data Sensitivity :
 Separation (yds) : Distance (yds):
 Front height (ft) : Rear height (ft) :

RRF Day: 0.1192 Night: 0.4325 Range: Not Ready

=====

Turn Region Data

Region Code : T3A Description : UP CHES LB 21, 24 & 25

Turn configuration (check one)

NonCutoff: Cutoff: X Bend: Extra width (ft) : 0.00

Turn angle (deg) : 12.00 Day: Type (1 - 3) : 3 Conforming? : N
Night: Type (1 - 3) : 3 Conforming? : N

Straight segment width : 600.00 Max crosstrack current (kts) : 0.50

Range Data

Separation (yds) : Sensitivity :
Front height (ft) : Distance (yds):
Rear height (ft) :

RRF Day: 0.0768 Night: 0.3991 Range: Not Ready

=====

Turn Region Data

Region Code : T4A Description : UP CHES LB 18-19-22

Turn configuration (check one)

NonCutoff: Cutoff: X Bend: Extra width (ft) : 0.00

Turn angle (deg) : 9.00 Day: Type (1 - 3) : 3 Conforming? : Y
Night: Type (1 - 3) : 3 Conforming? : Y

Straight segment width : 600.00 Max crosstrack current (kts) : 0.50

Range Data

Separation (yds) : Sensitivity :
Front height (ft) : Distance (yds):
Rear height (ft) :

RRF Day: 0.0282 Night: 0.2995 Range: Not Ready

=====

Recovery Region Data

Region Code : R1A Description : Upp Ches CH LB's 15 & 16

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |

Day: Conforming? : Y Night: Conforming? : Y

| | |
|---------------------|--------------------|
| Range Data | Sensitivity : |
| Separation (yds) : | Distance (yds): |
| Front height (ft) : | Rear height (ft) : |

RRF Day: 0.0000 Night: 0.0005 Range: Not Ready

=====

Recovery Region Data

Region Code : R2A Description : Up Ches CH LB's 13 & 14

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.50

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |

Day: Conforming? : Y Night: Conforming? : Y

| | |
|---------------------|--------------------|
| Range Data | Sensitivity : |
| Separation (yds) : | Distance (yds): |
| Front height (ft) : | Rear height (ft) : |

RRF Day: 0.0000 Night: 0.0005 Range: Not Ready

=====

Turn Region Configuration Options

Region Code : T1 Region Description : UP CHES LB 29-30
Region Width : 600.00 Cross Current : 0.50 Turn Angle : 13.00
Turn Type : NonCutoff

Daytime RRF Values

Nighttime RRF Values

Type One : 0.1192

0.4325

Type Two : 0.1192

0.4325

Type Three : 0.1192

0.2325

High Sensitivity Range : 0.4070

Low Sensitivity Range : 0.5719

=====

Turn Region Configuration Options

Region Code : T2 Region Description : UP CHES LB 27 & 28
Region Width : 600.00 Cross Current : 0.50 Turn Angle : 6.00
Turn Type : NonCutoff

Daytime RRF Values

Nighttime RRF Values

Type One : 0.1192

0.4325

Type Two : 0.1192

0.4325

Type Three : 0.1192

0.2325

High Sensitivity Range : 0.4070

Low Sensitivity Range : 0.5719

=====

Turn Region Configuration Options

Region Code : T3 Region Description : UP CHES LB 21, 24 & 25
Region Width : 600.00 Cross Current : 0.50 Turn Angle : 12.00
Turn Type : Cutoff Extra Width : 0.00
Nonconforming (Configuration or Environment)

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 0.5276 | 0.7221 |
| Type Two | : 0.0768 | 0.3991 |
| Type Three | : 0.0768 | 0.3991 |

High Sensitivity Range : 0.4070
Low Sensitivity Range : 0.5719

=====

Turn Region Configuration Options

Region Code : T4 Region Description : UP CHES LB 18-19-22
Region Width : 600.00 Cross Current : 0.50 Turn Angle : 9.00
Turn Type : Cutoff Extra Width : 0.00

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 0.4070 | 0.5621 |
| Type Two | : 0.0282 | 0.2995 |
| Type Three | : 0.0282 | 0.2995 |

High Sensitivity Range : 0.4070
Low Sensitivity Range : 0.5719

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : Upp Ches CH LB's 15 & 16
Region Width : 600.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0005 |
| Long Gated | : 0.0000 | 0.0005 |
| Short Staggered | : 0.0012 | 0.0012 |
| Long Staggered | : 0.0172 | 0.0172 |
| One Sided | : 0.0563 | 0.0563 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.1403

=====

Recovery Region Configuration Options

Region Code : R2 Region Description : Up Ches CH LB's 13 & 14
Region Width : 600.00 Cross Current : 0.50

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0005 |
| Long Gated | : 0.0000 | 0.0005 |
| Short Staggered | : 0.0012 | 0.0012 |
| Long Staggered | : 0.0172 | 0.0172 |
| One Sided | : 0.0563 | 0.0563 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.1403

Waterway : BREWERTON CHANNEL EASTERN EXT

File Name: BREWCHEAST.WWF

Comments : Existing 450-foot wide for 1-way traffic

Design Vessel Displ. (tons): 58988.40
Size (dwt): 55000.00
Length (ft): 965.00
Beam (ft): 106.00
Draft (ft): 33.00
Ht of Eye(ft): 90.00
Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.83
Nomoto Par. K* (-): 1.20
Nomoto Par. T* (-): 2.22

Totem Pole:

| Day RRF | Night RRF | Range RRF |
|---------|-----------|-----------|
| > 0.900 | | T1 |
| 0.800 | | |
| 0.700 | | |
| 0.600 | T1 | |
| 0.500 | | |
| 0.400 | | R1 |
| 0.300 | | K1 K2 K3 |
| 0.200 | | |
| 0.100 | | |
| 0.090 | | |
| 0.080 | | |
| 0.070 | | |
| 0.060 | | |
| 0.050 | R1 | |
| 0.040 | | |
| 0.030 | | |
| 0.020 | K1 K2 K3 | |
| 0.010 | | |
| 0.009 | | |
| 0.008 | | |
| 0.007 | R1 | |
| 0.006 | | |
| 0.005 | | |
| 0.004 | | |
| 0.003 | | |
| 0.002 | | |
| 0.001 | | |
| 0.000 | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 5 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|

Turn configuration (check one)

```

Turn angle (deg) : 69.00      Day: Type (1 - 3) : 3      Conforming? : N
                             Night: Type (1 - 3) : 3      Conforming? : N

```

```

Range Data                                     Sensitivity : 2.52
  Separation (yds) : 3850.00                 Distance (yds): 5700.00
  Front height (ft) : 30.00                  Rear height (ft) : 110.00

```

RRF Day: 0.3672 Night: 0.6207 Range: 1.0000 Upgraded Range: 1.0000

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 | 2353 | 2354 | 2355 | 2356 | 2357 | 2358 | 2359 | 2360 | 2361 | 2362 | 2363 | 2364 | 2365 | 2366 | 2367 | 2368 | 2369 | 2370 | 2371 | 2372 | 2373 | 2374 | 2375 | 2376 | 2377 | 2378 | 2379 | 2380 | 2381 | 2382 | 2383 | 2384 | 2385 | 2386 | 2387 | 2388 | 2389 | 2390 | 2391 | 2392 | 2393 | 2394 | 2395 | 2396 | 2397 | 2398 | 2399 | 2400 | 2401 | 2402 | 2403 | 2404 | 2405 | 2406 | 2407 | 2408 | 2409 | 2410 | 2411 | 2412 | 2413 | 2414 | 2415 | 2416 | 2417 | 2418 | 2419 | 2420 | 2421 | 2422 | 2423 | 2424 | 2425 | 2426 | 2427 | 2428 | 2429 | 2430 | 2431 | 2432 | 2433 | 2434 | 2435 | 2436 | 2437 | 2438 | 2439 | 2440 | 2441 | 2442 | 2443 | 2444 | 2445 | 2446 | 2447 | 2448 | 2449 | 2450 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

Navigable width (ft) : 450.00 Max crosstrack current (kts) : 0.70

| | | | | | | |
|--------|-----------|-----------|---|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): | X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): | X | Staggered(S): | Staggered(L): | 1-side: |

| | |
|----------------------------|---------------------------|
| Range Data | Sensitivity : 1.94 |
| Separation (yds) : 3850.00 | Distance (yds): 8250.00 |
| Front height (ft) : 30.00 | Rear height (ft) : 110.00 |

RRF Day: 0.0072 Night: 0.0569 Range: 0.4325 Upgraded Range: 0.02

=====

Trackkeeping Region Data

Region Code : K1A Description : BUOY 5 & 6

Navigable width (ft) : 450.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00
Front height (ft) : 30.00

Sensitivity : 1.65
Distance (yds): 10250.00
Rear height (ft) : 110.00

RRF Day: 0.0222 Night: 0.0222 Range: 0.3228 Upgraded Range: 0.00

=====

Trackkeeping Region Data

Region Code : K2A Description : Buoys 7 & 8

Navigable width (ft) : 450.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00
Front height (ft) : 30.00

Sensitivity : 1.43
Distance (yds): 12250.00
Rear height (ft) : 110.00

RRF Day: 0.0222 Night: 0.0222 Range: 0.3228 Upgraded Range: 0.00

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 | 2353 | 2354 | 2355 | 2356 | 2357 | 2358 | 2359 | 2360 | 2361 | 2362 | 2363 | 2364 | 2365 | 2366 | 2367 | 2368 | 2369 | 2370 | 2371 | 2372 | 2373 | 2374 | 2375 | 2376 | 2377 | 2378 | 2379 | 2380 | 2381 | 2382 | 2383 | 2384 | 2385 | 2386 | 2387 | 2388 | 2389 | 2390 | 2391 | 2392 | 2393 | 2394 | 2395 | 2396 | 2397 | 2398 | 2399 | 2400 | 2401 | 2402 | 2403 | 2404 | 2405 | 2406 | 2407 | 2408 | 2409 | 2410 | 2411 | 2412 | 2413 | 2414 | 2415 | 2416 | 2417 | 2418 | 2419 | 2420 | 2421 | 2422 | 2423 | 2424 | 2425 | 2426 | 2427 | 2428 | 2429 | 2430 | 2431 | 2432 | 2433 | 2434 | 2435 | 2436 | 2437 | 2438 | 2439 | 2440 | 2441 | 2442 | 2443 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

```

Range Data                               Sensitivity : 1.26
Separation (yds) : 3850.00              Distance (yds): 14250.00
Front height (ft) : 30.00               Rear height (ft) : 110.00

RRF Day: 0.0222      Night: 0.0222      Range: 0.3228      Upgraded Range: 0.00

```

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 | 2353 | 2354 | 2355 | 2356 | 2357 | 2358 | 2359 | 2360 | 2361 | 2362 | 2363 | 2364 | 2365 | 2366 | 2367 | 2368 | 2369 | 2370 | 2371 | 2372 | 2373 | 2374 | 2375 | 2376 | 2377 | 2378 | 2379 | 2380 | 2381 | 2382 | 2383 | 2384 | 2385 | 2386 | 2387 | 2388 | 2389 | 2390 | 2391 | 2392 | 2393 | 2394 | 2395 | 2396 | 2397 | 2398 | 2399 | 2400 | 2401 | 2402 | 2403 | 2404 | 2405 | 2406 | 2407 | 2408 | 2409 | 2410 | 2411 | 2412 | 2413 | 2414 | 2415 | 2416 | 2417 | 2418 | 2419 | 2420 | 2421 | 2422 | 2423 | 2424 | 2425 | 2426 | 2427 | 2428 | 2429 | 2430 | 2431 | 2432 | 2433 | 2434 | 2435 | 2436 | 2437 | 2438 | 2439 | 2440 | 2441 | 2442 | 2443 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

```

Region Code   : T1      Region Description : BUOY 2BE
Region Width  : 450.00   Cross Current  : 0.70   Turn Angle   : 69.00
Turn Type     : Cutoff   Extra Width    : 75.00
Nonconforming (Configuration or Environment)

```

| | Daytime RRF Values | Nighttime RRF Values |
|------------|--------------------|----------------------|
| Type One | : 0.9653 | 0.8667 |
| Type Two | : 0.3672 | 0.6207 |
| Type Three | : 0.3672 | 0.6207 |

High Sensitivity Range : 1.0000
Low Sensitivity Range : 1.0000

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : BUOY 3 & 4
Region Width : 450.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0072 | 0.0569 |
| Long Gated | : 0.0072 | 0.0569 |
| Short Staggered | : 0.0736 | 0.0736 |
| Long Staggered | : 0.1921 | 0.1921 |
| One Sided | : 0.2893 | 0.2893 |

High Sensitivity Range : 0.0287
Low Sensitivity Range : 0.4325

=====

Trackkeeping Region Configuration Options

Region Code : K1 Region Description : BUOY 5 & 6
Region Width : 450.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0005 | 0.0005 |
| Long Gated | : 0.0222 | 0.0222 |
| Short Staggered | : 0.0241 | 0.0241 |
| Long Staggered | : 0.0582 | 0.0582 |
| One Sided | : 0.1279 | 0.1279 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.3228

=====

Trackkeeping Region Configuration Options

Region Code : K2 Region Description : Buoys 7 & 8
Region Width : 450.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0005 | 0.0005 |
| Long Gated | : 0.0222 | 0.0222 |
| Short Staggered | : 0.0241 | 0.0241 |
| Long Staggered | : 0.0582 | 0.0582 |
| One Sided | : 0.1279 | 0.1279 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.3228

=====

Trackkeeping Region Configuration Options

Region Code : K3 Region Description : Buoys 9 & 10
Region Width : 450.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0005 | 0.0005 |
| Long Gated | : 0.0222 | 0.0222 |
| Short Staggered | : 0.0241 | 0.0241 |
| Long Staggered | : 0.0582 | 0.0582 |
| One Sided | : 0.1279 | 0.1279 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.3228

Waterway : BREWERTON CHANNEL EASTERN EXT
File Name: BREWCHEAST2.WWF
Comments : Existing 450-foot wide for 2-way traffic

Design Vessel Displ. (tons): 58988.40
Size (dwt): 55000.00
Length (ft): 965.00
Beam (ft): 106.00
Draft (ft): 33.00
Ht of Eye(ft): 90.00
Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.53
Nomoto Par. K* (-): 1.34
Nomoto Par. T* (-): 2.59

Totem Pole:

| Day RRF | | Night RRF | | Range RRF | |
|---------|----------|-----------|--|-------------|--|
| > 0.900 | T1 | T1 | | T1 | |
| 0.800 | | | | R1 K1 K2 K3 | |
| 0.700 | | | | | |
| 0.600 | K1 K2 K3 | K1 K2 K3 | | | |
| 0.500 | | | | | |
| 0.400 | | R1 | | | |
| 0.300 | R1 | | | | |
| 0.200 | | | | | |
| 0.100 | | | | | |
| 0.090 | | | | | |
| 0.080 | | | | | |
| 0.070 | | | | | |
| 0.060 | | | | | |
| 0.050 | | | | | |
| 0.040 | | | | | |
| 0.030 | | | | | |
| 0.020 | | | | | |
| 0.010 | | | | | |
| 0.009 | | | | | |
| 0.008 | | | | | |
| 0.007 | | | | | |
| 0.006 | | | | | |
| 0.005 | | | | | |
| 0.004 | | | | | |
| 0.003 | | | | | |
| 0.002 | | | | | |
| 0.001 | | | | | |
| 0.000 | | | | | |

=====

Turn Region Data

Region Code : T1 Description : BUOY 2BE

Turn configuration (check one)

NonCutoff: Cutoff: X Bend: Extra width (ft) : 0.00

Turn angle (deg) : 69.00 Day: Type (1 - 3) : 3 Conforming? : N

Night: Type (1 - 3) : 3 Conforming? : N

Straight segment width : 225.00 Max crosstrack current (kts) : 0.70

Range Data

Separation (yds) : 3850.00

Sensitivity : 1.26

Distance (yds): 5700.00

Front height (ft) : 30.00

Rear height (ft) : 110.00

RRF Day: 1.0000 Night: 1.0000 Range: 1.0000 Upgraded Range: 1.0

=====

Recovery Region Data

Region Code : R1A Description : BUOY 3 & 4

Navigable width (ft) : 225.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00

Sensitivity : 0.97

Distance (yds): 8250.00

Front height (ft) : 30.00

Rear height (ft) : 110.00

RRF Day: 0.3246 Night: 0.4849 Range: 0.8026 Upgraded Range: 0.4

=====

Trackkeeping Region Data

Region Code : K1A Description : BUOY 5 & 6

Navigable width (ft) : 225.00 Max crosstrack current (kts) : 0.70

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |

| | | | |
|------|-----------------|--------|-----------------|
| Day: | Conforming? : Y | Night: | Conforming? : Y |
|------|-----------------|--------|-----------------|

| | |
|----------------------------|---------------------------|
| Range Data | Sensitivity : 0.82 |
| Separation (yds) : 3850.00 | Distance (yds): 10250.00 |
| Front height (ft) : 30.00 | Rear height (ft) : 110.00 |

RRF Day: 0.6580 Night: 0.6580 Range: 0.8146 Upgraded Range: 0.09

=====

Trackkeeping Region Data

Region Code : K2A Description : BUOY 7 & 8

Navigable width (ft) : 225.00 Max crosstrack current (kts) : 0.70

SRA configuration:

| | | | | | |
|--------|-----------|-------------|---------------|---------------|---------|
| Day: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |
| Night: | Gated(S): | Gated(L): X | Staggered(S): | Staggered(L): | 1-side: |

| | | | |
|------|-----------------|--------|-----------------|
| Day: | Conforming? : Y | Night: | Conforming? : Y |
|------|-----------------|--------|-----------------|

| | |
|----------------------------|---------------------------|
| Range Data | Sensitivity : 0.72 |
| Separation (yds) : 3850.00 | Distance (yds): 12250.00 |
| Front height (ft) : 30.00 | Rear height (ft) : 110.00 |

RRF Day: 0.6580 Night: 0.6580 Range: 0.8146 Upgraded Range: 0.09

[illegible]

Region Code : K3A Description : BUOY 9 & 10

Navigable width (ft) : 225.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Day: Conforming? : Y Night: Conforming? : Y

Range Data Sensitivity : 0.63

Separation (yds) : 3850.00 Distance (yds): 14250.00

Front height (ft) : 30.00 Rear height (ft) : 110.00

Sensitivity : 0.63

Distance (yds): 14250.00

Rear height (ft) : 110.00

RRF Day: 0.6580 Night: 0.6580 Range: 0.8146 Upgraded Range: 0.8146

.....

Region Code : T1 Region Description : BUQY 2BE

Region Width : 225.00 Cross Current : 0.70 Turn Angle : 69.00

| | | | |
|-----------|----------|-------------|--------|
| Turn Type | : Cutoff | Extra Width | : 0.00 |
|-----------|----------|-------------|--------|

Nonconforming (Configuration or Environment)

[illegible]

Nighttime RRF Values

```

Type One      : 1.0000      1.0000

```

```

Type Two      : 1.0000      1.0000

```

```
Type Three      : 1.0000      1.0000
```

High Sensitivity Range : 1.0000

Low Sensitivity Range : 1.0000

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : BUOY 3 & 4
Region Width : 225.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.3246 | 0.4849 |
| Long Gated | : 0.3246 | 0.4849 |
| Short Staggered | : 0.5070 | 0.5070 |
| Long Staggered | : 0.6351 | 0.6351 |
| One Sided | : 0.6821 | 0.6821 |

High Sensitivity Range : 0.8026
Low Sensitivity Range : 0.8026

=====

Trackkeeping Region Configuration Options

Region Code : K1 Region Description : BUOY 5 & 6
Region Width : 225.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.4470 | 0.4470 |
| Long Gated | : 0.6580 | 0.6580 |
| Short Staggered | : 0.6191 | 0.6191 |
| Long Staggered | : 0.6670 | 0.6670 |
| One Sided | : 0.7587 | 0.7587 |

High Sensitivity Range : 0.8146
Low Sensitivity Range : 0.8146

=====

Trackkeeping Region Configuration Options

Region Code : K2 Region Description : BUOY 7 & 8
Region Width : 225.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

Short Gated : 0.4470

0.4470

Long Gated : 0.6580

0.6580

Short Staggered : 0.6191

0.6191

Long Staggered : 0.6670

0.6670

One Sided : 0.7587

0.7587

High Sensitivity Range : 0.8146

Low Sensitivity Range : 0.8146

=====

Trackkeeping Region Configuration Options

Region Code : K3 Region Description : BUOY 9 & 10
Region Width : 225.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

Short Gated : 0.4470

0.4470

Long Gated : 0.6580

0.6580

Short Staggered : 0.6191

0.6191

Long Staggered : 0.6670

0.6670

One Sided : 0.7587

0.7587

High Sensitivity Range : 0.8146

Low Sensitivity Range : 0.8146

Waterway : BREWERTON CHANNEL EASTERN EXT

File Name: BREW600.WWF

Comments : Proposed 600' wide for 1-way traffic

Design Vessel Displ. (tons): 58988.40

Size (dwt): 55000.00

Length (ft): 965.00

Beam (ft): 106.00

Draft (ft): 33.00

Ht of Eye(ft): 90.00

Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.83

Nomoto Par. K* (-): 1.20

Nomoto Par. T* (-): 2.22

Totem Pole:

| Day RRF | Night RRF | Range RRF |
|---------|-----------|-----------|
| > 0.900 | | T1 |
| 0.800 | | |
| 0.700 | | |
| 0.600 | | |
| 0.500 | | |
| 0.400 | T1 | |
| 0.300 | | |
| 0.200 | | |
| 0.100 | | R1 |
| 0.090 | | |
| 0.080 | | K1 K2 K3 |
| 0.070 | | |
| 0.060 | | |
| 0.050 | | |
| 0.040 | | |
| 0.030 | | |
| 0.020 | | |
| 0.010 | | |
| 0.009 | | |
| 0.008 | | |
| 0.007 | | |
| 0.006 | | |
| 0.005 | | |
| 0.004 | | |
| 0.003 | | |
| 0.002 | R1 | |
| 0.001 | | |
| 0.000 | K1 K2 K3 | |

=====

Turn Region Data

Region Code : T1 Description : BUOY 2BE

Turn configuration (check one)

NonCutoff: Cutoff: X Bend: Extra width (ft) : 75.00

Turn angle (deg) : 69.00 Day: Type (1 - 3) : 3 Conforming? : N
Night: Type (1 - 3) : 3 Conforming? : N

Straight segment width : 600.00 Max crosstrack current (kts) : 0.70

Range Data

Separation (yds) : 3850.00 Sensitivity : 3.36
Front height (ft) : 30.00 Distance (yds): 5700.00
Rear height (ft) : 110.00

RRF Day: 0.1327 Night: 0.4044 Range: 0.9160

=====

Recovery Region Data

Region Code : R1A Description : BUOY 3 & 4

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00 Sensitivity : 2.59
Front height (ft) : 30.00 Distance (yds): 8250.00
Rear height (ft) : 110.00

RRF Day: 0.0000 Night: 0.0024 Range: 0.1953 Upgraded Range: 0.00

[illegible]

RRF Day: 0.0002 Night: 0.0002 Range: 0.0883 Upgraded Range: 0.00

.....

RRF Day: 0.0002 Night: 0.0002 Range: 0.0883 Upgraded Range: 0.0

=====

Trackkeeping Region Data

Region Code : K3A Description : Buoys 9 & 10

Navigable width (ft) : 600.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side
 Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Day: Conforming? : Y Night: Conforming? : Y

Range Data Sensitivity : 1.68
 Separation (yds) : 3850.00 Distance (yds): 14250.00
 Front height (ft) : 30.00 Rear height (ft) : 110.00

RRF Day: 0.0002 Night: 0.0002 Range: 0.0883 Upgraded Range: 0.00

=====

Turn Region Configuration Options

Region Code : T1 Region Description : BUOY 2BE
 Region Width : 600.00 Cross Current : 0.70 Turn Angle : 69.00
 Turn Type : Cutoff Extra Width : 75.00
 Nonconforming (Configuration or Environment)

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 0.7284 | 0.7188 |
| Type Two | : 0.1327 | 0.4044 |
| Type Three | : 0.1327 | 0.4044 |

High Sensitivity Range : 0.9160
 Low Sensitivity Range : 1.0000

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : BUOY 3 & 4
 Region Width : 600.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0024 |
| Long Gated | : 0.0000 | 0.0024 |
| Short Staggered | : 0.0046 | 0.0046 |
| Long Staggered | : 0.0376 | 0.0376 |
| One Sided | : 0.0960 | 0.0960 |

High Sensitivity Range : 0.0004
 Low Sensitivity Range : 0.1953

=====

Trackkeeping Region Configuration Options

Region Code : K1 Region Description : BUOY 5 & 6
 Region Width : 600.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0000 |
| Long Gated | : 0.0002 | 0.0002 |
| Short Staggered | : 0.0005 | 0.0005 |
| Long Staggered | : 0.0041 | 0.0041 |
| One Sided | : 0.0132 | 0.0132 |

High Sensitivity Range : 0.0000
 Low Sensitivity Range : 0.0883

=====

Trackkeeping Region Configuration Options

Region Code : K2 Region Description : Buoys 7 & 8
Region Width : 600.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0000 |
| Long Gated | : 0.0002 | 0.0002 |
| Short Staggered | : 0.0005 | 0.0005 |
| Long Staggered | : 0.0041 | 0.0041 |
| One Sided | : 0.0132 | 0.0132 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.0883

=====

Trackkeeping Region Configuration Options

Region Code : K3 Region Description : Buoys 9 & 10
Region Width : 600.00 Cross Current : 0.70

Daytime RRF Values

Nighttime RRF Values

| | | |
|-----------------|----------|--------|
| Short Gated | : 0.0000 | 0.0000 |
| Long Gated | : 0.0002 | 0.0002 |
| Short Staggered | : 0.0005 | 0.0005 |
| Long Staggered | : 0.0041 | 0.0041 |
| One Sided | : 0.0132 | 0.0132 |

High Sensitivity Range : 0.0000
Low Sensitivity Range : 0.0883

Waterway : BREWERTON CHANNEL EASTERN EXT
 File Name: BREW300.WWF
 Comments : Proposed 600' wide for 2-way traffic

Design Vessel Displ. (tons): 58988.40
 Size (dwt): 55000.00
 Length (ft): 965.00
 Beam (ft): 106.00
 Draft (ft): 33.00
 Ht of Eye(ft): 90.00
 Speed (kts): 10.00

Controllability Indices

Tactical Diameter (osl): 3.83
 Nomoto Par. K* (-): 1.20
 Nomoto Par. T* (-): 2.22

Totem Pole:

| Day RRF | Night RRF | Range RRF |
|---------|-----------|-------------|
| > 0.900 | | T1 |
| 0.800 | T1 | |
| 0.700 | | |
| 0.600 | | R1 K1 K2 K3 |
| 0.500 | | |
| 0.400 | | |
| 0.300 | K1 K2 K3 | |
| 0.200 | R1 | |
| 0.100 | | |
| 0.090 | | |
| 0.080 | | |
| 0.070 | | |
| 0.060 | | |
| 0.050 | | |
| 0.040 | | |
| 0.030 | | |
| 0.020 | | |
| 0.010 | | |
| 0.009 | | |
| 0.008 | | |
| 0.007 | | |
| 0.006 | | |
| 0.005 | | |
| 0.004 | | |
| 0.003 | | |
| 0.002 | | |
| 0.001 | | |
| 0.000 | | |

.....

Turn configuration (check one)

```

Turn angle (deg) : 69.00      Day: Type (1 - 3) : 3      Confirming? : N
                             Night: Type (1 - 3) : 3      Confirming? : N

```

Range Data

Sensitivity : 1.68
Distance (yds): 5700.00
Rear height (ft) : 110.00

.....

Region Code : R1A Description : BUOY 3 & 4

SRA configuration:

Day: Conforming? : Y Night: Conforming? : Y

Sensitivity : 1.30
Distance (yds): 8250.00
Rear height (ft) : 110.00

RRF Day: 0.1312 Night: 0.2833 Range: 0.6820 Upgraded Range: 0.24

=====

Trackkeeping Region Data

Region Code : K1A Description : BUOY 5 & 6

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00
Front height (ft) : 30.00

Sensitivity : 1.10
Distance (yds): 10250.00
Rear height (ft) : 110.00

RRF Day: 0.3201 Night: 0.3201 Range: 0.6498 Upgraded Range: 0.00

=====

Trackkeeping Region Data

Region Code : K2A Description : Buoys 7 & 8

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:
Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side:

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00
Front height (ft) : 30.00

Sensitivity : 0.95
Distance (yds): 12250.00
Rear height (ft) : 110.00

RRF Day: 0.3201 Night: 0.3201 Range: 0.6498 Upgraded Range: 0.00

=====

Trackkeeping Region Data

Region Code : K3A Description : Buoys 9 & 10

Navigable width (ft) : 300.00 Max crosstrack current (kts) : 0.70

SRA configuration:

Day: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side
 Night: Gated(S): Gated(L): X Staggered(S): Staggered(L): 1-side

Day: Conforming? : Y Night: Conforming? : Y

Range Data

Separation (yds) : 3850.00

Sensitivity : 0.84

Front height (ft) : 30.00

Distance (yds): 14250.00

Rear height (ft) : 110.00

RRF Day: 0.3201 Night: 0.3201 Range: 0.6498 Upgraded Range: 0.00

=====

Turn Region Configuration Options

Region Code : T1 Region Description : BUOY 2BE
 Region Width : 300.00 Cross Current : 0.70 Turn Angle : 69.00
 Turn Type : Cutoff Extra Width : 75.00

Nonconforming (Configuration or Environment)

Daytime RRF Values

Nighttime RRF Values

| | | |
|------------|----------|--------|
| Type One | : 1.0000 | 1.0000 |
| Type Two | : 0.7002 | 0.8375 |
| Type Three | : 0.7002 | 0.8375 |

High Sensitivity Range : 1.0000

Low Sensitivity Range : 1.0000

=====

Recovery Region Configuration Options

Region Code : R1 Region Description : BUOY 3 & 4
 Region Width : 300.00 Cross Current : 0.70

| Daytime RRF Values | | Nighttime RRF Values |
|--------------------|----------|----------------------|
| Short Gated | : 0.1312 | 0.2833 |
| Long Gated | : 0.1312 | 0.2833 |
| Short Staggered | : 0.3108 | 0.3108 |
| Long Staggered | : 0.4628 | 0.4628 |
| One Sided | : 0.5388 | 0.5388 |

High Sensitivity Range : 0.2454
 Low Sensitivity Range : 0.6820

=====

Trackkeeping Region Configuration Options

Region Code : K1 Region Description : BUOY 5 & 6
 Region Width : 300.00 Cross Current : 0.70

| Daytime RRF Values | | Nighttime RRF Values |
|--------------------|----------|----------------------|
| Short Gated | : 0.1023 | 0.1023 |
| Long Gated | : 0.3201 | 0.3201 |
| Short Staggered | : 0.2858 | 0.2858 |
| Long Staggered | : 0.3566 | 0.3566 |
| One Sided | : 0.5018 | 0.5018 |

High Sensitivity Range : 0.0013
 Low Sensitivity Range : 0.6498

=====

Trackkeeping Region Configuration Options

Region Code : K2 Region Description : Buoys 7 & 8
 Region Width : 300.00 Cross Current : 0.70

| Daytime RRF Values | | Nighttime RRF Values |
|---------------------------------|----------|----------------------|
| Short Gated | : 0.1023 | 0.1023 |
| Long Gated | : 0.3201 | 0.3201 |
| Short Staggered | : 0.2858 | 0.2858 |
| Long Staggered | : 0.3566 | 0.3566 |
| One Sided | : 0.5018 | 0.5018 |
| High Sensitivity Range : 0.0013 | | |
| Low Sensitivity Range : 0.6498 | | |

=====

Trackkeeping Region Configuration Options

Region Code : K3 Region Description : Buoys 9 & 10
 Region Width : 300.00 Cross Current : 0.70

| Daytime RRF Values | | Nighttime RRF Values |
|---------------------------------|----------|----------------------|
| Short Gated | : 0.1023 | 0.1023 |
| Long Gated | : 0.3201 | 0.3201 |
| Short Staggered | : 0.2858 | 0.2858 |
| Long Staggered | : 0.3566 | 0.3566 |
| One Sided | : 0.5018 | 0.5018 |
| High Sensitivity Range : 0.0013 | | |
| Low Sensitivity Range : 0.6498 | | |